

TRANSMITTAL LETTER TO THE UNITED STATES
DESIGNATED/ELECTED OFFICE (DO/EO/US)
CONCERNING A FILING UNDER 35 U.S.C. 371

U.S. APPLICATION NO. (If known, see 37 CFR 1.5)

09/674022

INTERNATIONAL APPLICATION NO.
PCT/DE99/01121INTERNATIONAL FILING DATE
15 April 1999
(15.04.99)PRIORITY DATE CLAIMED:
24 April 1998
(24.04.98)TITLE OF INVENTION
METHOD FOR THE TRANSMISSION OF DATA, AND APPARATUS FOR THE TRANSMISSION OF DATAAPPLICANT FOR DO/EO/US
Frank KOWALEWSKI

Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information

1. ☒ This is a **FIRST** submission of items concerning a filing under 35 U.S.C. 371.
2. ☐ This is a **SECOND** or **SUBSEQUENT** submission of items concerning a filing under 35 U.S.C. 371.
3. ☒ This is an express request to begin national examination procedures (35 U.S.C. 371(f)) immediately rather than delay examination until the expiration of the applicable time limit set in 35 U.S.C. 371(b) and PCT Articles 22 and 39(1).
4. ☒ A proper Demand for International Preliminary Examination was made by the 19th month from the earliest claimed priority date.
5. ☒ A copy of the International Application as filed (35 U.S.C. 371(c)(2))
 - ☐ is transmitted herewith (required only if not transmitted by the International Bureau).
 - ☒ has been transmitted by the International Bureau.
 - ☐ is not required, as the application was filed in the United States Receiving Office (RO/US)
6. ☒ A translation of the International Application into English (35 U.S.C. 371(c)(2)).
7. ☒ Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371(c)(3))
 - ☐ are transmitted herewith (required only if not transmitted by the International Bureau).
 - ☐ have been transmitted by the International Bureau.
 - ☐ have not been made; however, the time limit for making such amendments has NOT expired.
 - ☒ have not been made and will not be made.
8. ☐ A translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)).
9. ☒ An oath or declaration of the inventor (35 U.S.C. 371(c)(4)). (unsigned)
10. ☒ A translation of the annexes to the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371(c)(5)).

Items 11. to 16. below concern other document(s) or information included:

11. ☒ An Information Disclosure Statement under 37 CFR 1.97 and 1.98.
12. ☐ An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included.
13. ☒ A **FIRST** preliminary amendment
☐ A **SECOND** or **SUBSEQUENT** preliminary amendment.
14. ☐ A substitute specification.
15. ☐ A change of power of attorney and/or address letter.
16. ☒ Other items or information: International Search Report, PCT/RO/101 and International Preliminary Examination Report.

Express Mail No.:

EL594608811US

U.S. APPLICATION NO. if known, see 37 C.F.R. 1.5

09/6740.22

INTERNATIONAL APPLICATION NO.
PCT/DE99/01121ATTORNEY'S DOCKET NUMBER
10191/155417. ☒ The following fees are submitted:**Basic National Fee (37 CFR 1.492(a)(1)-(5)):**

Search Report has been prepared by the EPO or JPO \$860.00
 International preliminary examination fee paid to USPTO (37 CFR 1.482) \$690.00
 No international preliminary examination fee paid to USPTO (37 CFR 1.482)
 but international search fee paid to USPTO (37 CFR 1.445(a)(2)) \$710.00
 Neither international preliminary examination fee (37 CFR 1.482) nor international
 search fee (37 CFR 1.445(a)(2)) paid to USPTO \$1000.00
 International preliminary examination fee paid to USPTO (37 CFR 1.482) and all
 claims satisfied provisions of PCT Article 33(2)-(4) \$100.00

CALCULATIONS | PTO USE ONLY

ENTER APPROPRIATE BASIC FEE AMOUNT =

\$860

Surcharge of \$130.00 for furnishing the oath or declaration later than ☐ 20 ☐ 30 months
 from the earliest claimed priority date (37 CFR 1.492(e)).

\$

Claims	Number Filed	Number Extra	Rate		
Total Claims	9 - 20 =	0	X \$18.00	\$0	
Independent Claims	3 - 3 =	0	X \$80.00	\$0	
Multiple dependent claim(s) (if applicable)			+ \$270.00	\$	

TOTAL OF ABOVE CALCULATIONS =

\$860

Reduction by 1/2 for filing by small entity, if applicable. Verified Small Entity statement must
 also be filed. (Note 37 CFR 1.9, 1.27, 1.28).

\$

SUBTOTAL =

\$860

Processing fee of \$130.00 for furnishing the English translation later the ☐ 20 ☐ 30
 months from the earliest claimed priority date (37 CFR 1.492(f)).

+

\$

TOTAL NATIONAL FEE =

\$860

Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be
 accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31). \$40.00 per property

+

\$

TOTAL FEES ENCLOSED =

\$860

Amount to be:

refunded

\$

charged

\$

- a. ☐ A check in the amount of \$_____ to cover the above fees is enclosed.
- b. ☒ Please charge my Deposit Account No. 11-0600 in the amount of \$860.00 to cover the above fees.
 A duplicate copy of this sheet is enclosed.
- c. ☒ The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any overpayment to
 Deposit Account No. 11-0600. A duplicate copy of this sheet is enclosed.

NOTE: Where an appropriate time limit under 37 CFR 1.494 or 1.495 has not been met, a petition to revive (37 CFR 1.137(a) or (b))
 must be filed and granted to restore the application to pending status.

SEND ALL CORRESPONDENCE TO:

Kenyon & Kenyon
 One Broadway
 New York, New York 10004

SIGNATURE

Richard L. Mayer, Reg. No. 22,490
 NAME

DATE

24 OCT 2000

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Inventor : Frank KOWALEWSKI
Serial No. : To Be Assigned
Filed : Herewith
For : METHOD FOR THE TRANSMISSION OF DATA,
AND APPARATUS FOR THE TRANSMISSION OF
DATA
Examiner : To Be Assigned
Art Unit : To Be Assigned

Assistant Commissioner for Patents
Washington, D.C. 20231

PRELIMINARY AMENDMENT

SIR:

Kindly amend the above-identified application before examination, as set forth below.

IN THE TITLE:

Please replace the title with the following new title:

--METHOD FOR THE TRANSMISSION OF DATA, AND APPARATUS FOR THE
TRANSMISSION OF DATA--.

IN THE DRAWINGS:

Please amend the drawings as indicated in the attached red-marked sheets.

IN THE SPECIFICATION:

Please amend the specification as follows:

On page 1, delete lines 1-4, and insert:

--FIELD OF THE INVENTION

The present invention relates to a system and a method for transmitting data.

EL594608811115

BACKGROUND INFORMATION

An article--.

On page 1, line 8, replace "has already disclosed" with --describes--.

On page 1, line 9, delete "so-called".

On page 1, delete lines 19-20, and insert:

--SUMMARY--.

On page 1, line 21, replace "The method and the" with --A method and an--.

On page 1, line 22, replace "the advantage, in contrast," with --an advantage in--.

On page 1, line 25, delete "therefore", and before "particularly", insert --a--.

On page 1, line 28, delete "particularly".

On page 1, line 33, before "particularly", insert --a--.

On page 1, line 37, delete "particularly".

On page 2, delete lines 4-21, and insert:

--BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 shows a representation of a mobile radio system or mobile telephone system according to the present invention.

Figure 2 shows a base station and a mobile station in a downlink transmission.

Figure 3 shows data transmission from a base station to a mobile station according to the present invention.

Figure 4 shows data transmission from a mobile station to a base station according to the present invention.--.

On page 2, delete lines 22-23, and insert:

--DETAILED DESCRIPTION--.

On page 2, line 26, delete “What is essential”.

On page 2, delete line 27, and insert:

--An exchange of data occurs--.

On page 2, line 37, replace “of this kind as depicted” with --as illustrated--.

On page 2, line 42, delete “so-called”.

On page 2, line 43, after “system,”, insert --for example,--.

On page 4, line 22, replace “as a rule have only” with --generally have--.

On page 4, line 23, delete “thus also only”.

On page 5, line 25, replace “depicted” with --depicts--.

On page 5, line 27, delete “advantageously”.

On page 5, line 33, replace “would be” with --is--.

On page 5, line 34, replace “according to” with --illustrated in--.

On page 5, line 36, replace “becomes” with --is--.

On page 7, delete line 1, and insert:

--What Is Claimed Is--.

IN THE ABSTRACT:

Please amend the Abstract, as follows:

Delete line 1, and insert:

-- Abstract Of The Disclosure--.

Line 3, replace “is proposed” with --and a system are described--.

Line 4, delete “(1)”, and delete “(2)”.

Line 5, delete “(3)”.

Line 6, delete “(4)”.

Line 8, delete “(3)”.

Line 9, delete “(3)”, and delete “(Figure 3)”.

IN THE CLAIMS:

Please cancel original claims 1-9, without prejudice. Please also cancel, without prejudice, claims 1, 5 and 8 of the revised page of the Annex to the International Preliminary Examination Report.

Please add the following new claims:

--10. (New) A method for transmitting data between a base station and mobile stations via radio channels, comprising the steps of:

spreading data of different mobile stations with different codes; and
performing, in a modulator, a pre-equalization of signals to be transmitted, the pre-equalization taking into account all of the different codes and transmission properties of the radio channels.

11. (New) The method according to claim 10, further comprising the step of:
transmitting the data from the base station to the mobile stations.
12. (New) The method according to claim 10, further comprising the step of:
transmitting the data from the mobile stations to the base station.
13. (New) The method according to claim 10, further comprising the step of:
ascertaining, via the base station, the transmission properties of the radio
channels from data transmissions from the mobile stations to the base station.
14. (New) An apparatus for transmitting data via at least one radio channel, the
apparatus being used in a system that couples a base station and mobile stations via
radio channels, the data of different mobile stations being spread with different codes,
comprising:
a modulator;
a code generator coupled to the modulator, the code generator providing
all of the different codes; and
a channel estimator coupled to the modulator, the channel estimator
providing transmission properties of all of the radio channels,
wherein the modulator performs a pre-equalization of signals to be
transmitted, the pre-equalization being based on information received from the
code generator and the channel estimator.
15. (New) The apparatus according to claim 14, wherein the data is transmitted from
the base station to the mobile stations.
16. (New) The apparatus according to claim 14, wherein the data is transmitted from
the mobile stations to the base station.
17. (New) A system for transmitting data via at least one radio channel, comprising:
a base station; and
mobile stations coupled with the base station via radio channels, the data
of different mobile stations being spread with different codes,

wherein one of (A) the base station and (B) each of the mobile stations includes:

a modulator,
a code generator coupled to the modulator, the code generator providing all of the different codes, and
a channel estimator coupled to the modulator, the channel estimator providing transmission properties of all of the radio channels, the modulator performing a pre-equalization of signals to be transmitted, the pre-equalization being based on information received from the code generator and the channel estimator.

18. (New) The system according to claim 17, wherein the base station ascertains the transmission properties of the radio channels from data transmissions from the mobile stations to the base station.--.

Remarks

This Preliminary Amendment cancels, without prejudice, original claims 1-9 in the underlying PCT Application No. PCT/DE99/01121. This Preliminary Amendment further cancels, without prejudice, claims 1, 5 and 8 of the revised page in the Annex to the International Preliminary Examination Report, and adds new claims 10-18. The new claims conform the claims to U.S. Patent and Trademark Office rules and do not add new matter to the application.

The above amendments to the title, drawings, specification and abstract conform the title, drawings, specification and abstract to U.S. Patent and Trademark Office rules and correct informalities noted by the Applicant during the preparation of this Preliminary Amendment. The amendments to the title, drawings, specification and abstract do not introduce new matter into the application.

The underlying PCT Application No. PCT/DE99/01121 includes an International Search Report, dated September 2, 1999. The International Search Report includes a list of documents that were uncovered in the underlying PCT Application. A copy of the International Search Report is included herewith. Also enclosed is a translation of the International Search Report.

The underlying PCT Application also includes an International Preliminary

Examination Report, dated March 29, 2000. A copy of the International Preliminary Examination Report and corresponding Annex is included herewith. Also enclosed is a translation of the International Preliminary Examination Report and the corresponding Annex.

It is respectfully submitted that the subject matter of the present application is new, non-obvious, and useful. Prompt consideration and allowance of the application are respectfully requested.

Respectfully submitted,

by: [Signature] (Reg No 36091)

Dated: 21 Oct 2000

By: [Signature]

Richard L. Mayer
Reg. No. 22,490

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311495

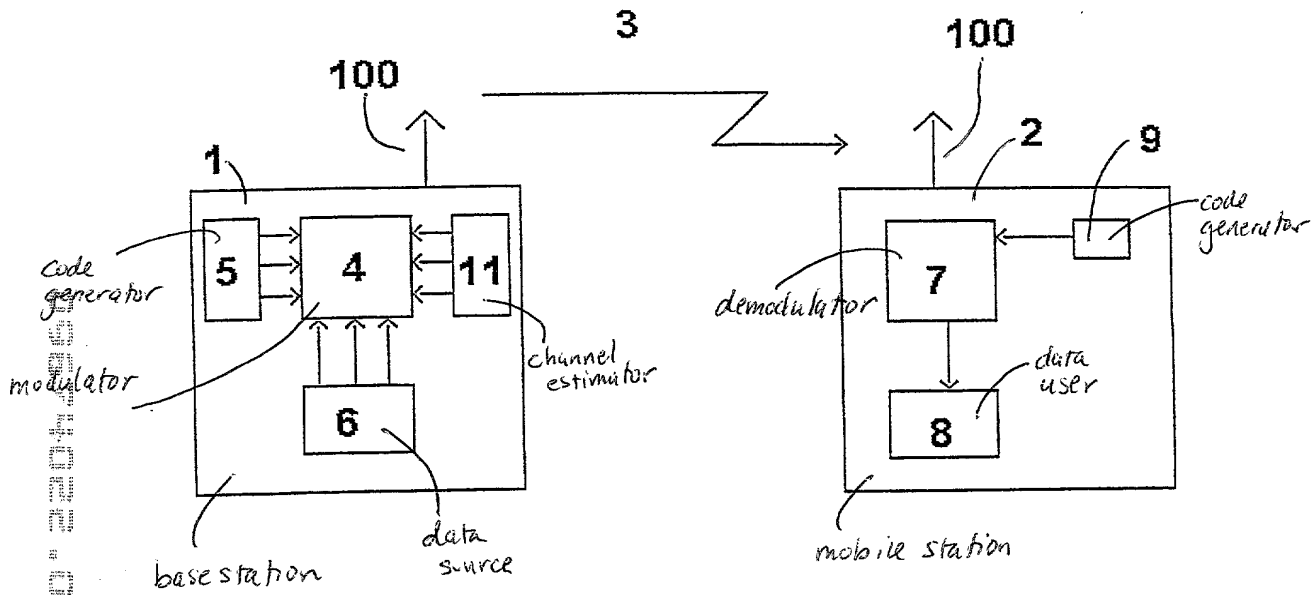


Fig. 3

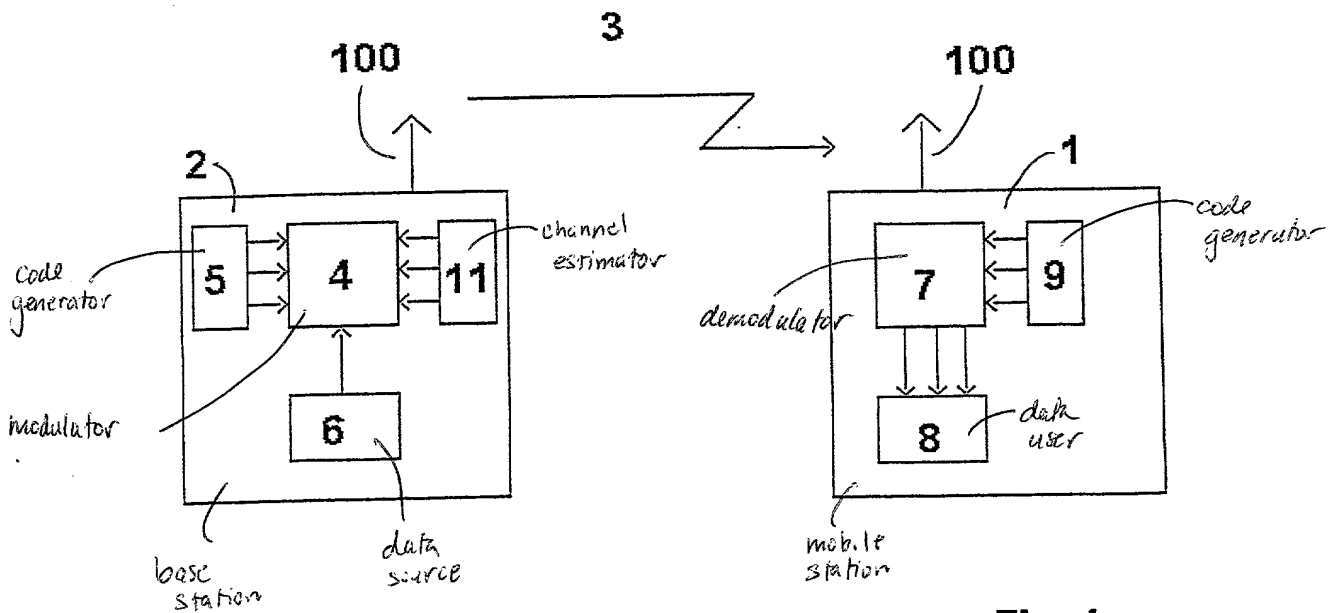


Fig. 4

**METHOD FOR THE TRANSMISSION OF DATA, AND APPARATUS FOR THE
TRANSMISSION OF DATA****Background of the Invention**

The invention is based on a method and an apparatus according to the species defined in the independent claims. An article
5 by A. Klein, G.K. Kaleh, and P.W. Baier: "Zero Forcing and Minimum Mean-Square-Error Equalization for Multiuser Detection in Code-Division Multiple-Access Channels," IEEE Trans. Vehic. Tech., Vol. 45 (1996), 276-287 has already disclosed methods
10 which take into account so-called inter-symbol interferences (ISI) between data symbols of a user, and multiple-access interferences (MAI), i.e., interferences due to other users, in a receiver for radio data. All interferences affecting the transmission are thus taken into account at the receiver. When
15 methods of this kind are used in mobile telephone systems or mobile radio systems, the individual mobile stations are very complex, since this method makes severe technical demands on the receiver.

Advantages of the Invention

The method and the apparatus according to the present
20 invention have the advantage, in contrast, that all interferences that can occur as a result of the radio transmission are taken into account at the transmitter. The
25 receiver of the data can therefore be of particularly simple design.

This is particularly advantageous for the transmission of data from one base station to a plurality of mobile stations. For
30 the return transmission, it is then possible to use a method or an apparatus that takes all interferences into account at the receiver end, so that the individual mobile stations of a mobile telephone system can be of particularly simple design. The method and apparatus according to the present invention
35 can, however, also be used for data transmission from mobile stations to base stations. Measurement of the transmission quality or channel pulse response is accomplished particularly

easily in the base station, and optionally can be distributed from there.

Drawings

Exemplary embodiments of the invention are explained in more detail in the description below. In the drawings:

Figure 1 shows the general configuration of a mobile radio system or mobile telephone system;

Figure 2 shows a conventional system according to the existing art;

Figure 3 shows data transmission according to the present invention from one base station to a mobile station; and

Figure 4 shows data transmission according to the present invention from a mobile station to a base station.

Description

Figure 1 schematically depicts a radio cell of a cellular mobile telephone system or mobile radio system, with a base station 1 and several mobile stations 2. What is essential about this system is that an exchange of data always occurs only between base station 1 and mobile stations 2, and no direct data exchange among mobile stations 2 is possible. Correspondingly, base station 1 is also referred to as the central station, and mobile stations 2 as peripheral stations. The exchange of data between base station 1 and mobile station 2 is accomplished by radio transmission. The radio transmission from base station 1 to a mobile station 2 is referred to as the downlink, and the data transmission from a mobile station 2 to the base station 1 as the uplink. In a system of this kind as depicted in Figure 1, with one central or base station 1 and several peripheral or mobile stations 2, a definition must be made as to how the data for the various mobile stations are modulated so that they can be separately detected in the receivers of the various mobile stations. The system shown in Figure 1 is a so-called CDMA (Code Division Multiple Access) system, in which one common frequency band is

available for data transmission and the individual data channels between base station 1 and the respective mobile stations 2 differ in terms of a code with which the signal for the corresponding mobile station 2 is spread. As a result of this spreading with the code, each signal that is to be exchanged between base station 1 and a specific mobile station 2 is distributed over the entire available spectrum. Each individual information bit that is to be transmitted is broken down into a plurality of small "chirps". As a result, the energy of a bit is distributed over the entire frequency spectrum available to the CDMA system.

In Figure 2, conventional systems are explained in more detail with reference to a downlink transmission. Figure 2 shows a base station 1 and a mobile station 2, each of which has an antenna 100. Here the two stations are exchanging data via a downlink radio channel 3. Base station 1 has a modulator 4 which prepares the data streams of data sources 6 for transmission via radio channel 3. For this, modulator 4 also requires code data that are made available by a code generator 5. As an example, Figure 2 shows three arrows from data sources 6 to modulator 4, and three arrows from code generator 5 to modulator 4, representing three different data streams and three different code data. In real systems, a substantially greater number of data streams and code data are processed simultaneously.

From the data streams and the code data, modulator 4 generates a transmitted signal which is sent to all mobile stations 2. Figure 2 depicts, as an example, only one receiving mobile station 2. In the case of a single mobile station 2 with a single data stream, one code datum would be needed in base station 1. As a rule, however, base station 1 transmits simultaneously over several radio channels 3 to several mobile stations 2 whose respective data are modulated with different codes. For reasons of simplicity, the further mobile stations 2 are not depicted in Figure 2.

A plurality of interferences occur in the transmission via radio channel 3. A first interference is referred to as "inter-symbol interference" (ISI), and results because an emitted radio signal can reach the receiver via several different paths with slight differences in arrival time at the

receiver. This is therefore an interference that occurs in the relevant radio channel because signals emitted earlier in time interfere with signals presently being received (hence "inter-symbol interference"). A further interference occurs because several data streams which differ only in terms of their code are being transmitted simultaneously. This interference occurs if base station 1 is simultaneously in radio contact with several mobile stations 2, which represents the usual case with modern mobile telephone systems. This is thus an interference that results from signals of different users, and is therefore also referred to as "multiple-access interference" (MAI).

Figure 2 shows the receiving section of a mobile station 2 that is intended for the reception of downlink data via radio channel 3. Provided for this purpose is a demodulator 7 that processes the radio signals received via antenna 100. Demodulator 7 processes the received signals in order to generate from them a data stream for a data user 8. If the transmitted data represent, for example, voice data, then user 8 is a voice decoder; with other data it is, for example, a computer or fax device. Mobile stations as a rule have only a single data user 8 and thus also only a single data stream. If the transmission via radio channel 3 were completely without interference, demodulator 7 would need, for demodulation, to know only the code datum of the data to be detected for user 8. Because of the interferences described above, however, this is not sufficient. What is needed in order to take into account ISI is a channel estimator 10 that makes information about transmission properties, i.e., the channel pulse response of radio channel 3, available to the relevant mobile station 2. To compensate for MAI, mobile station 2 must additionally know all the codes used in the base station. A code generator 9 that makes available not only the code datum for the data to be detected here, but also code data for all the codes used in the system, is provided for that purpose. This method is also referred to as "joint detection." The mobile stations that are designed in this fashion for the reception of data from base station 1 are relatively complex.

The method and apparatus according to the present invention will now be explained in more detail with reference to Figure 3, which also shows the downlink transmission from one base

station 1 to a mobile station 2. In Figure 3, base station 1 again has a modulator 4 that generates the transmitted signals for an antenna 100 of base station 1. Modulator 4 obtains from data sources 6 several data streams which are spread with code data of a code generator 5. Additionally provided is a channel estimator 11 that makes available information about the transmission properties of all radio channels 3. In this instance modulator 4 generates a transmitted signal which takes into account both ISI and MAI. The transmitted signal is designed in each case so that upon reception (to the extent it is possible), each of mobile stations 2 receives an interference-free signal. Both the interferences resulting from the simultaneous use of multiple codes, and the interferences resulting from the transmission properties of the individual radio channels, are thereby taken into account. In Figure 3, the receiver of the data configured by mobile station 2 is then correspondingly simple. It has a demodulator 7 that receives the signal from antenna 100. All that needs to be made available to this demodulator 7, from a code generator 9, is the code datum for the relevant data stream, from which demodulator 7 then generates the data stream for data user 8. The mobile stations in this instance are thus of particularly simple configuration.

Figure 3 depicted the fact that in the case of a downlink transmission, all interferences affecting the radio channel are advantageously taken into account in the transmitting station, i.e., in the base station in the case of a downlink transmission. The downlink section of mobile station 2 can therefore be of particularly simple configuration. In order to make mobile station 2 simple for the uplink path as well, i.e., for the transmission of data from mobile station 2 to base station 1, it would be possible to use for this transmission the method according to Figure 2, in which ISI and MAI are taken into account in the receiving station, i.e., once again in the base station. A system thus becomes possible in which the mobile stations are of particularly simple configuration, since ISI and MAI are taken into account exclusively in the base station. In a corresponding TDD system, it is also very easy to obtain the channel transmission properties by way of channel estimator 11 in base station 1, by the fact that the properties of the respective transmission channels can be ascertained by analyzing the

received uplink data in the base station. Furthermore, the channel pulse response or channel quality can also be transferred via a data telegram from the mobile station to the base station.

The method according to the present invention can also be used to send data from mobile station 2 to base station 1. This is depicted in Figure 4. Here mobile station 2 is depicted in an uplink, i.e., with modulator 4 which is preparing a data stream of a data source 6. In order to take into account the transmission properties of all radio channels 3 and codes used in the system, a code generator 5 is provided which transfers to demodulator 4 the code data of all the codes used in the system, along with a channel estimator 11 which supplies the transmission properties of all the radio channels. The information concerning the transmission properties of all the channels could be made available to mobile station 2 by base station 1. In modulator 4, the interferences due to multipath transmission on radio channel 3 and due to simultaneous transmission of several data streams are taken into account when the radio signal is generated. The radio signal is sent via antenna 100 and radio link 3 to base station 1. Base station 1 receives not only the data of mobile station 2 shown in Figure 4, but simultaneously also the radio signals of other mobile stations (not depicted in Figure 4). Demodulator 7 of base station 1 correspondingly has all the code data fed to it from code generator 9, and decodes several data streams for several data users 8. Here, however, it is no longer necessary to provide a channel estimator for decoding.

The method with which the transmission properties of all radio links (ISI) and the codes of all radio links (MAI) are taken into account is described below by way of mathematical formulas. These formulas can be executed either by way of a corresponding program or by corresponding hardware modules which implement these formulas.

Claims

1. A method for the transmission of data between one base station (1) and several mobile stations (2) via radio channels (3), the data of different mobile stations being spread with different codes, characterized in that a pre-equalization of the signals to be transmitted is performed in a modulator (4); and that all the different codes and the transmission properties of all radio channels (3) are taken into account in the pre-equalization.
2. The method as defined in Claim 1, characterized in that data are transmitted from one base station (1) to a plurality of mobile stations (2).
3. The method as defined in Claim 1, characterized in that data are transmitted from a plurality of mobile stations (2) to one base station (1).
4. The method as defined in one of the foregoing claims, characterized in that the transmission properties of the radio channels (3) are ascertained by the base stations (1) from data transmissions by the mobile stations (2) to the base station (1).
5. An apparatus for the transmission of data via at least one radio channel, the apparatus being used in a system that connects one base station and several mobile stations via radio channels (3), the data of different mobile stations being spread with different codes, characterized in that a modulator (4), a code generator (5), and a channel estimator (11) are provided; and that the modulator (4) performs a pre-equalization based on data of the code generator (5) and of the channel estimator (11).
6. The apparatus as defined in Claim 5, characterized in that data are transmitted from one base station (1) to a plurality of mobile stations (2).
7. The apparatus as defined in Claim 5, characterized in that data are transmitted from a plurality of mobile stations (2) to one base station (1).

8. A system for the transmission of data via at least one radio channel (3), having one base station and several mobile stations, the data of different mobile stations being spread with different codes, characterized in that a modulator (4), a code generator (5), and a channel estimator (11) are provided; and that the modulator (4) performs a pre-equalization based on data of the code generator (5) and of the channel estimator (11).
9. The system as defined in Claim 8, characterized in that the transmission properties of the radio channels (3) are ascertained by the base stations (1) from data transmissions by the mobile stations (2) to the base stations (1).

Abstract

5 A method is proposed for the transmission of data between one base station (1) and several mobile stations (2) via radio channels (3), the data streams each differing in terms of a code. In a modulator (4), a pre-equalization of the signals is performed in which the transmission properties of all the radio channels (3) and the different codes of all the radio channels (3) are taken into account (Figure 3).

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1/2

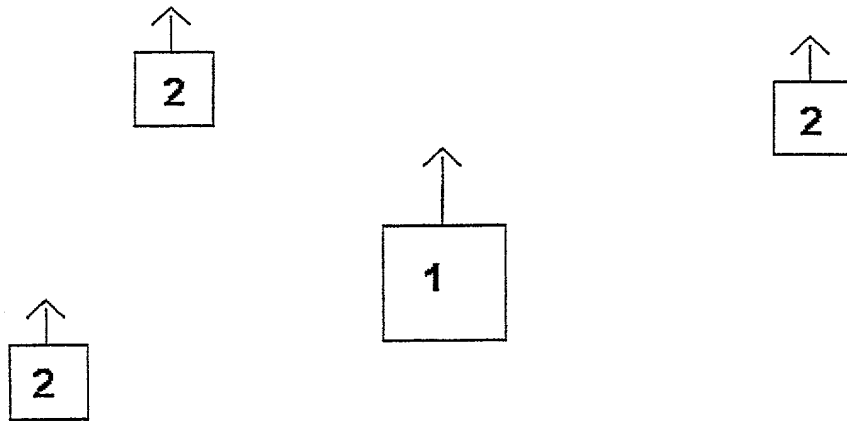


Fig. 1

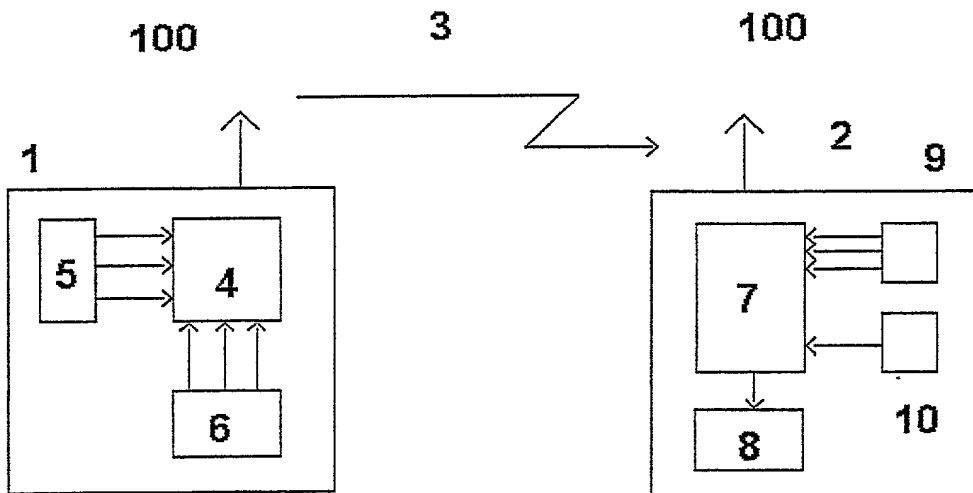


Fig. 2

2/2

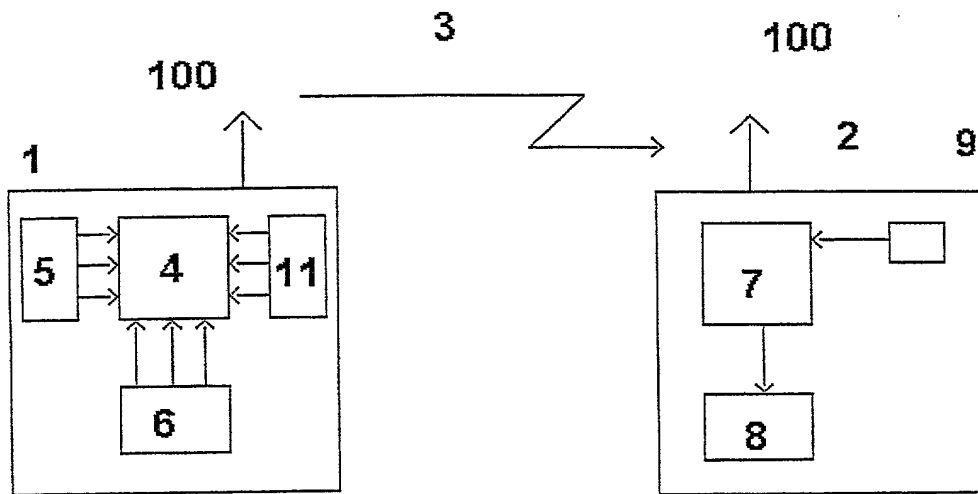


Fig. 3

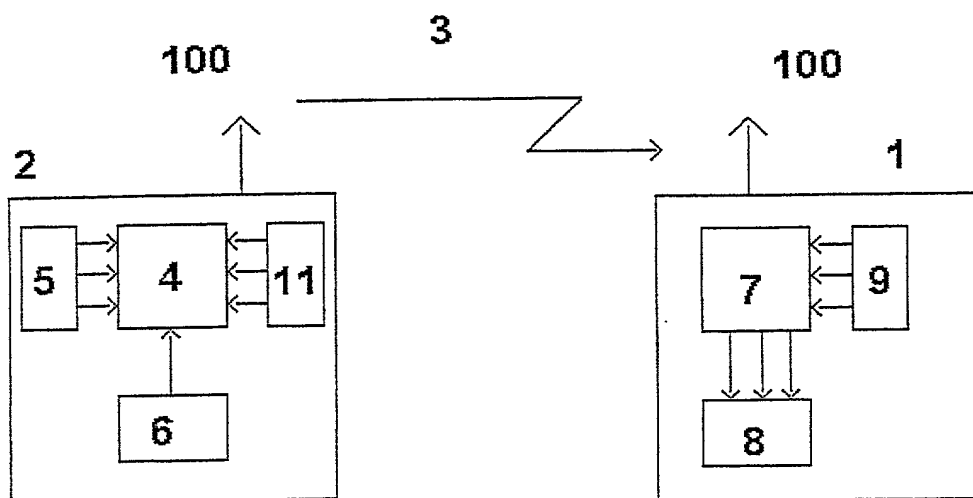


Fig. 4

**PRIOR FOREIGN/PCT APPLICATION(S)
AND ANY PRIORITY CLAIMS UNDER 35 U.S.C. § 119**

Country : Federal Republic of Germany

Application No. : 198 18 215.5

Date of Filing : April 24, 1998

Priority Claimed

Under 35 U.S.C. § 119 : ☒ Yes ☐ No

I hereby claim the benefit under Title 35, United States Code § 120 of any United States Application or PCT International Application designating the United States of America that is/are listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in that/those prior application(s) in the manner provided by the first paragraph of Title 35, United States Code § 112, I acknowledge the duty to disclose material information as defined in Title 37, Code of Federal Regulations § 1.56(a) which occurred between the filing date of the prior application(s) and the national or PCT international filing date of this application:

**PRIOR U.S. APPLICATIONS OR
PCT INTERNATIONAL APPLICATIONS
DESIGNATING THE U.S. FOR BENEFIT UNDER 35 U.S.C. § 120**

U.S. APPLICATIONS

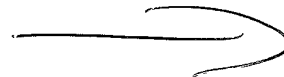
Number :

Filing Date :

PCT APPLICATIONS
DESIGNATING THE U.S.

PCT Number :

PCT Filing Date :



I hereby appoint the following attorneys and/or agents to prosecute the above-identified application and transact all business in the Patent and Trademark Office connected therewith.

(List names and registration numbers):

Richard L. Mayer, Reg. No. 22,490
Gerard A. Messina, Reg. No. 35,952



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Inventor's signature *F. Kowalewski* Date 11.1.2001

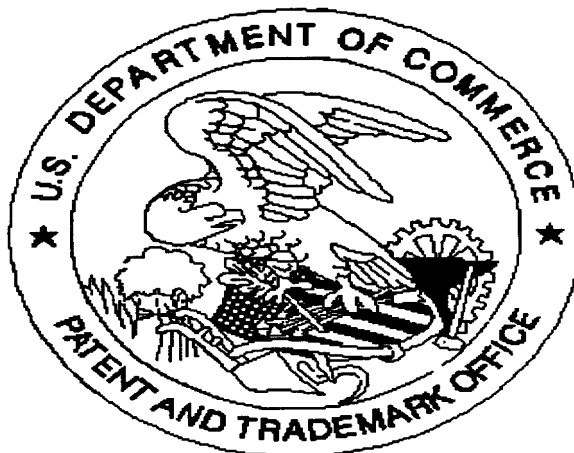
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